LINEAR SWEEP

Paladin Prep in Korea

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If a unit needs to hold the shoulder of a defile as friendly forces breach an obstacle and pass through on the attack, one solution is the classic breach—suppress, obscure, secure, reduce (SOSR). If the suppression and obscuration are both effective and continuous, the timing and interval of the approach march are correct and there are no problems reducing the obstacle, then the essential fire support task (EFST) will be successful.

But an alternative, one that may hold less uncertainty and risk, is to place fires on the enemy position in such volume and with such distribution that the defeat of the enemy position is mathematically guaranteed. This "blunt-instrument" approach is historically proven and likely to succeed—even when the friction or fog of war is intense enough to have disrupted the elegant SOSR ballet. The blunt-instrument approach is particularly effective in Korea and other areas of close terrain where platoon positions on the shoulders of a defile can control both entry and exit to critical maneuver red zones.

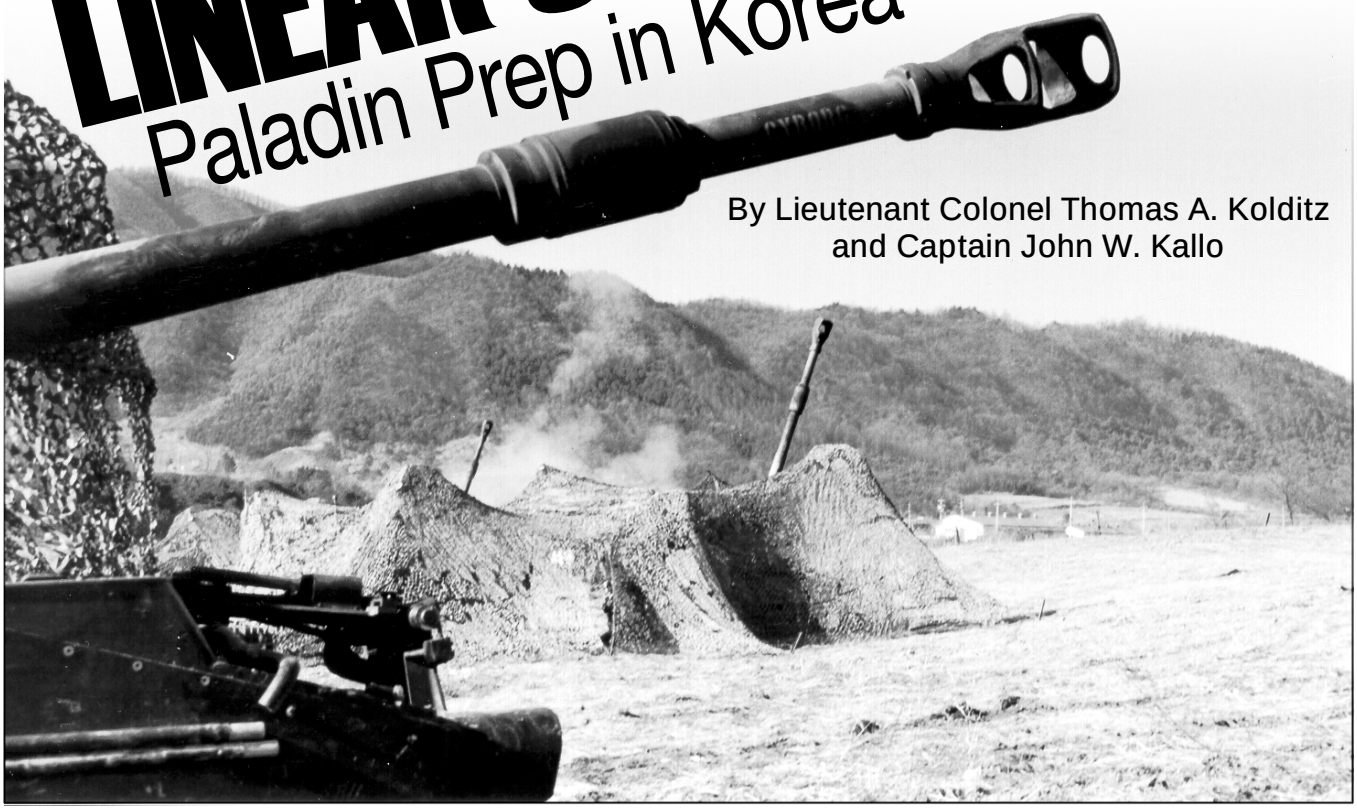
In this article, we discuss the revised and refined art of the artillery preparation: the linear sweep in Korea. We outline how to use the capabilities of the M109A6 Paladin howitzer to put high-volume, evenly distributed fires on dug-in infantry forces and armored vehicles for maximum effects.

Historical Background. Gunners in the former Warsaw Pact armies were particularly adept at planning high-volume fires. During the January 1945 Vistula Oder Offensive Operation, for example, the 8th Guards Army massed 350 artillery pieces per kilometer of breakthrough front.[1] These and other artillery pieces contributed to a 107-minute preparation across the front with one 25-minute segment delivering 315,000 projectiles into the German's collapsing defense.

Such heavy concentrations of fire have an enormous logistical cost associated with them. For that reason and because our artillery developed under Cold War paradigms of being vastly outnumbered by enemy guns, the US Army has not trained extensively to deliver high rates of highly lethal fires. We've used very lethal improved conventional munitions (ICM) and very efficient technical and tactical fire direction systems, substituting precision and responsiveness for the brute force of tons of explosives.

High-Volume Fires. In our combined arms warfighting doctrine, we often practice the *suppression* of known enemy locations, in theory, allowing maneuver forces to gain positional advantage to defeat or disrupt the enemy. This is a necessary tactic in many instances, but sometimes it makes more sense for the maneuver force to exercise tactical patience while artillery renders the target completely ineffective rather than temporarily suppressed. Suppression, unfortunately, is like the matador's cape—it's effective for a short time, but if it's inadvertently dropped, you have to deal with the bull.

Recently, a respected maneuver commander "graded" a fire support officer (FSO) on providing effective suppression at a breach. He said, "If a friendly vehicle is destroyed in the support-by-fire position or the breach, you get a 'D.' If two friendly vehicles are destroyed, you get an 'F.'" At that point, the FSO—who was an "A" student—inferred the intent for fires was to destroy, rather than suppress, the overwatching enemy attack-by-fire positions. So, in concert with his fire support coordinator (FSCOORD), he put more than 350 rounds of dual-purpose improved conventional munitions (DPICM) on the target—an immediate and permanent solution to the problem. No friendly vehicles were destroyed during the breaching operation. A 300-



C/2-17 FA, Paladin

by-300-meter or 300-by-600-meter position is well within the capabilities of a focused artillery battalion to take down with a high volume of fires.

What constitutes a "high volume" in this instance? In Chris Bellamy's classic work on Soviet artillery, *The Red God of War*, the Soviet process for computing such fires is explained in mathematical detail. Using the calculations, "norms can be obtained which will practically guarantee the destruction of any target if the rules are followed."[2] His term "any target" includes dug-in tanks and infantry fighting vehicles and dug-in infantry.

The assumption is that an artillery round must strike or nearly strike the reinforced targets to achieve a kill. The computations are organized in tables for easy use in the field. The Soviet term for "suppression" means 30 percent destruction of the enemy force—the US artillery's doctrinal requirement for destruction fires. (See Figure 1.)

Current North Korean doctrine promulgates this same approach using Warsaw Pact and the North Korean People's Army (NKPA) howitzers, such as the 170-mm Koksan gun, the M1973 152 self-propelled (SP) and heavy mortars. Intelligence officers sometimes dismiss the effectiveness of these pieces because of their inaccuracy. But high rates of fire actually take advantage of the inaccuracy of large circular error probable (CEP) weapons to achieve an ellipsoidal, relatively even distribution of effects on area targets.

When adroitly employed, modern howitzers, such as Paladin, can produce even better effects. The accuracy provided by individual piece corrections, aim points by piece, the rapid application of meteorological data and other technological advantages now enable the FSCOORD to pattern the distribution of effects across the targeted position deliberately.

In addition, the use of palletized load system (PLS) vehicles—organic to mechanized direct support (DS) battalions—make the expenditure of 300 to 600 rounds on an EFST well within the organic capability of the battalion. The battalion can resource such a volume of fires within its typical unit basic load (UBL) and estimated daily controlled supply rates (CSRs). The 350 rounds for an EFST represents less than 10 percent of most UBLs and about three of the 18 PLS flatracks generally available to the FSCOORD.

A Battery of Towed Guns, Ranges up to 10 Kilometers								
	Rifled Weapons			Mortars			Rocket Launchers	
Caliber, mm	122	130	152	120	160	240	Medium	Heavy
Number of Rounds	220	200	180	200	120	100	400	170
A Battery of Self-Propelled Guns, Ranges up to 10 Kilometers								
Caliber, mm	122	130	152	120	160	240	Medium	Heavy
Number of Rounds	380	260	290	300	290	175	440	210

Figure 1: Table of Norms for Suppression (30 Percent Destruction) for a 200-by-300-Meter Position (*The Red God of War,* Christopher Bellamy, Page 65)

Distributing Effects. It's the even distribution of effects, not just the volume of fires, that kills. The Soviets merely used volume to achieve distribution. We know from classified studies of munitions effects that to render mobility, firepower or communication kills on tanks and achieve crew and catastrophic kills on lightly armored vehicles most effectively, high-explosive (HE) rounds must land on top or within a few meters of the armored vehicles. Even distribution across area targets is particularly important when vehicles are dug-in, but such vehicles *can* be rendered ineffective by near airbursts or ground bursts on or inside their defensive berms.

This reveals a fallacy in training exercise rules of engagement (ROE) that require a certain level of explosive weight to kill a target (for example, 108 artillery rounds to kill a tank). It only takes one round if the density and distribution puts the projectile on or within a few feet of the target.

ICM projectiles increase the efficiency of the process by distributing bomblets rather than fragments. When time permits and especially in support of light infantry, densely distributed HE fires also can be effective on all known armored vehicles.

Given that we want to achieve an even distribution of fire across a position, what are the tactics, techniques and procedures (TTP) for the Paladin to achieve that distribution? The example in the current *FM 6-40 TTP for Field Artillery Manual Cannon Gunnery* for engaging a 300-meter area target is battery fire using six aim points. This is obviously appropriate only for the temporary suppression of lightly armored or unprotected troops—*hardly* representative of the "King of Battle."

The solution to the problem has two components: high-volume fires and a deliberate distribution of effects. Paladin's consistency and accuracy make the deliberate, even distribution of effects necessary to prevent pounding a few parts of an area target while missing others. Taking into account the tabular firing table's (TFT's) predicted range and lateral spread, anyone who has spent time "on the hill" can verify that multiple rounds fired from single howitzers tend to land close to one another—sometimes with craters touching at the shorter ranges. An even distribution of effects on an area target simply cannot be achieved with only a few aim points.

Historically, an alternative gunnery technique for distributing effects between volleys was to roll a barrage across a large enemy position—in Soviet terminology, a "fire curtain."[3] This was done by using the optical sight, adjusting quadrant by a few mils between volleys (zone fire), adjusting deflections between volleys (sweep fire), or adjusting both deflection and quadrant between volleys (sweep and zone fire).

The M100 series optical sight in the Paladin can be used for sweep and zone fire, but many of the technical advantages of the howitzer are lost when the optical sight is in use. The procedures for sweep and zone fires (FM 6-40 "Appendix H, Special Situations") are designed to quickly engage a large and (or) irregularly shaped target; the computations are based on using the weapon's burst width to determine sheaf front (sweep fire) or sheaf depth (zone fire). With advanced technology and automated fire direction procedures and delivery systems, traditional sweep and zone techniques require adaptation from older optical sights to the capabilities inherent in Paladin's automated fire control system (AFCS).

In addition, the distance between bursts should be decreased to less than a burst width. By decreasing the distance be-

tween bursts, the fire direction officer (FDO) can deliver fires that saturate the target area and maximize the effects against enemy assets and forces in the target area.

Linear Sweep—How To. One tested and effective TTP to deliver such dense area of fires is called a "linear sweep." Simply put, a linear sweep takes a dense, linear target computed by the Paladin's AFCS and sweeps it across the enemy position using a series of small subsequent corrections. These corrections are planned ahead at the platoon operations center (POC), so immediately after the POC receives "Shot" from the first volley, it sends a subsequent correction to each howitzer. One-round-per-minute sustained rates of fire can be achieved (and even surpassed) during this mission.

Recently, the Chief of Infantry wrote a penetrating article on fire support in the close fight and referred to the preparation as a "dying art."[4] The linear sweep is a preparation art form alive and well at the DS level and well suited to Paladin's capabilities.

The linear sweep provides an overwhelming volume of fire with incremental shifts in impact location, "carpeting" a designated target with indirect fires. Under ideal conditions, all the battalion's 18 Paladin howitzers fire 18 rounds each into a 300-meter-square target area, thus expending 324 rounds. (See Figure 2.) The box in Figure 2 covers a 300-meter-square platoon position when using HE with point detonating (PD) fuzes and is expanded to a 600-meter-square box when using DPICM.

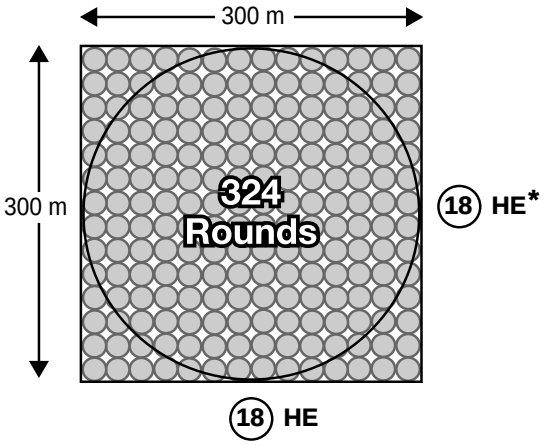
After the initial linear volley, rapid subsequent corrections form an area sheaf that ensures an HE projectile will impact less than eight meters from every enemy vehicle in the box (on an average). The close proximity of these impacts should achieve kills (defined as catastrophic, mobility, communications or fire control) on *all* vehicles and more than 75 percent of all personnel in the target area, *regardless* of their protective posture. The ICM linear sweep achieves a similar effect with 88 submunitions spaced within 16 meters of each vehicle in a 600-meter box.

The following outlines the linear sweep's initial computation steps, its execution, time parameters and adjustment techniques. Additionally, we discuss procedures for executing the mission with a reduced number of howitzers.

Initial Computation. The linear sweep can be conducted as either a planned target or a target of opportunity. First, the controlling maneuver commander determines the location of the box and the controlling FSO determines a center aim point. Based on this information, the battalion FDO uses an attitude appropriate for the target area to add 150 meters (in the case of DPICM, 300 meters) to the center aim point, based on the 300-meter or 600-meter box, respectively. This provides the top (first linear sheaf) of the target box and defines the target area.

This initial linear sheaf is then segmented into six platoon-sized sheafs. The battalion fire direction center (FDC) determines the six platoon center aim points using chart paper or a map. The quickest method is to use a template with a mark for the center aim point and holes to mark each platoon's sheaf center aim point.

Once determined, the FDC transmits the aim points to the individual POCs via digital plain text message (the preferred method) or voice as a priority target. Each POC uses the aim point to compute a 50-meter linear target for its firing platoon, employing an "At My Command" (AMC) method of control. Once all the guns are laid on their initial aim points, the POCs report "Ready" back to the battalion FDC in preparation for mission execution. No special procedures are required by the POCs or howitzers and mission training plan (MTP) standards apply to both the computations and the crew drill.



*HE is used for simplicity. Dual-purpose improved conventional munition (DPICM) missions are identical in execution, but a 600-meter battalion linear target and subsequent corrections of 33 meters create a 600-by-600-meter effects pattern.

Figure 2: Linear Sweep Effects Pattern using High Explosives (HE)

Execution. The initial volley of the linear sweep is conducted under the direction of the battalion FDC to maximize the elements of mass and surprise on the target. The initial volley is fired on the top of the box as determined by the controlling FSO or the battalion FDO. For the HE mission, all subsequent corrections are a "drop 15"; for the ICM mission, the corrections are a "drop 33." To further confuse the enemy as to where and when the next rounds will impact, succeeding volleys are fired by the individual howitzer sections using a "When Ready" (WR) method of control. The observer-target (OT) direction is kept at a constant 6,400 mils to maintain the target box's alignment.

Time Parameters. Once the target location is received, the battalion FDC needs eight minutes for tactical and technical fire direction and transmission of the POCs' initial aim points. The POCs and guns require one minute and 35 seconds for technical fire direction and the howitzer crew drill.

The MTP standard for firing an "At My Command" linear target with 17 subsequent corrections at low angle is 22 minutes and 30 seconds. The test battalion for the TTP executed this mission live-fire in 21 minutes and 10 seconds. The MTP standard for high angle is 28 minutes and 30 seconds. The same battalion fired its high-angle mission in 24 minutes and 25 seconds. (When establishing the time standards, one battery live fired the missions due to the restrictive nature of firing in the Republic of Korea; the remainder of the battalion simultaneously dry fired the missions).

Adjusting Methods. If the FDO needs to adjust the target box, he determines the method of adjustment by the size of the adjustment or refinement. When the initial target location refinement is less than 1,000 meters, the POCs are notified of a correction for the initial volley with "Cease loading target number xxxxxx; shift correction left [or right] xxx meters and add [or drop] xx meters." The POCs compute the data for the new aim points, and the mission is ready for execution on the refined

target box. A correction of this type requires two minutes and 10 seconds of technical procedures from the battalion FDC to the POCs and down to the gun line. Refinements of more than 1,000 meters require the FDC to recompute the mission, especially if there is an altitude change of more than 100 meters.

In the case of a mission with non-fleeting targets, an adjustment round is used to verify target location. While this eliminates the element of surprise, it may be acceptable to ensure destruction of a high-payoff target (HPT).

Density of the Prep. FM 6-40 "Appendix H, Special Situations" discusses the special fire distribution techniques necessary to ensure proper coverage and ammunition usage when engaging large targets (larger than 250 meters). The FM 6-40 solution for a 300-meter-square area target, for example, places six guns on only six aim points.

Linear sweep is a much more aggressive use of artillery fires and is a Paladin version of earlier sweep and zone techniques used with optical sights. The large size of the target and the high density of fires accounts for minor target location errors (TLEs), various target types and all protective postures in which the enemy force can array itself. Put simply, the linear sweep is absolutely lethal.

If friendly howitzers are lost, the linear sweep still can be executed effectively. The only significant change is reducing the size of the target box to be engaged. By doing so, the TTP attribute of density of effects is not diminished. Based on the TTP's foundation, 18 tubes provide the optimal coverage for the 300-meter-square target box. The same density of coverage can be achieved on a 250-by-300-meter box when 15 howitzers are available and on a 200-by-300-meter box with 12 howitzers (the Soviet platoon position). The corresponding coverage using DPICM is 18 tubes for a 600-meter-square box, 15 tubes for a 500-by-600-meter box and 12 for a 400-by-600-meter box. The execution times remain the same for these reduced target sizes, and the effects are dramatic to observe.

Moving Targets. The linear sweep can be adapted to engage fleeting targets. Instead of moving the fires in the box from the "top" edge to the "bottom," the initial sheaf is fired across the center aim point for the initial volley. The succeeding volleys are fired by directing alternating add and drop corrections. This allows the firing unit to walk the fires from the center to the top and bottom edges of the target box to maximize effects against a displacing enemy force.

Training the Fire Support System. The fire direction and fire support portions of the DS battalion killing system must be trained on linear sweep TTP. In effect, the linear sweep is the revival of the preparation at the lowest possible level—the enemy platoon position. As with all TTP, repetitive drills involving all elements of the system are vital.

The FDO must be able to anticipate and manage the unique aspects of the TTP, such as aligning his linear target and anticipating subsequent corrections. The FSO must practice setting conditions for the use of the technique, making rapid adjustments and managing execution time. Section chiefs and gunners must understand the sense of urgency required to maintain the tempo of firing. In our brigade combat team in Korea, the linear sweep EFST often was assigned to Apache pilots who were setting conditions for a subsequent air assault.

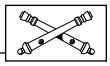
All parts of the fire support system must train with the TTP until they are comfortable and then rehearse until they can perform under the stress of execution. Resources permitting, it should be rehearsed live.

Units must be careful when using minimum safe distances (MSDs) and risk estimate distances (REDs) to conduct high-volume live fires. The peacetime MSD and wartime RED buffers against fratricide are computed on the basis of probabilities.[5] That is, given the terminal ballistics and range/lateral probable errors (PEs) associated with firing, the likelihood of injury to approaching troops is estimated and a small buffer is established for combined arms training and combat.

Trainers should be particularly conservative using probability-based buffers during events featuring high volumes of artillery fire because each round is a single probability trial. It is obvious that probability-associated effects from a battery-six versus a battalion-18 is different and more dangerous in the latter case.

High-volume fires are a twist to the more common "suppressive" approaches to close support, and many infantrymen and fire supporters are initially skeptical about a shift in paradigm. Some will argue that using high-volume fires is unrealistic and logistically prohibitive—show them the math. Some will argue that high-volume fires are overkill and a waste of ammunition—introduce them to Murphy and the fog of war. Others may argue that tanks and infantry with 18 inches of overhead cover can't be decisively engaged by artillery—show them the tapes. If training realism is maintained by adjudicating 90 percent to 100 percent kills on the maneuver forces struck by properly computed high-volume fires, the technique will sell itself.

The point is that the linear sweep is timeless. Doctrine and weapons systems are just tools. And they are only as good as the effects they produce. The onus remains on the fire supporter to be a master craftsman, to get the job done for the maneuver commander—and remain the *King of Battle* in the close fight.



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Endnotes:

1. Christopher Bellamy, *The Red God of War*, (New York: Brassey's Defence Publishers, 1986), 65.
2. Ibid., 182.
3. Ibid., 183.
4. Major General Carl F. Ernst, "Is the FA Walking Away from the Close Fight?" *Field Artillery* (September-October 1999), 8-11.
5. Major Gerald Pokorski and Lonnie R. Minton, "Risk Estimate Distances for Indirect Fires in Combat," *Field Artillery* (March-April 1997), 8-10.